ITEM 1k

Agreement between California Energy Commission and Gas Technology Institute

Title: Solar-Assisted Industrial Heating
Amount: $399,973.00
Term: 36 months
PIER Contact: Donald Kazama
RD&D Committee: 12/3/2009

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
09	Natural Gas	IAW	Emerging Technology Demonstration Program	$400,000	$399,973	$0	0%

For the 2009 fiscal year, the total Natural Gas budget is $24 million. Within the Natural Gas program, the IAW program area budget is $1.8 million and, from this amount, $0.4 million was allocated to the Emerging Technology Demonstration Program budget initiative. If approved, the remaining initiative balance will be $0.00.

Recommendation

Approve this agreement with Gas Technology Institute for $399,973.00, with $564,483.00 in match funding. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

The Problem

The term "solar thermal" is used to refer to a variety of different technologies. For the most part, commercially available flat plate and evacuated tube collectors exhibit good efficiency characteristics at lower temperatures (176°F/80°C) but heat losses mean their efficiencies fall off rapidly at higher temperatures (212°F/100°C). The highest end of the solar thermal temperature range (392°F/200°C to over 1200°F/650°C) uses parabolic troughs, compact linear Fresnel reflectors (CLFR), and power towers for large scale power generation installations. However, the temperature spectrum between about 212°F/100°C and 392°F/200°C has been largely neglected by market incumbents and will be uniquely addressed by the subject technology. This range includes a wide variety of compelling heat driven industrial process applications including:

- Double effect absorption chilling
- Boiler feedwater and commercial hot water
- Industrial drying and other process requiring heat between 212°F/100°C and 392°F/200°C

Proposed Research

Gas Technology Institute (GTI), SAB Miller, and H2Go are proposing a pilot solar thermal installation utilizing medium temperature non-tracking solar collectors at the SAB Miller brewing facility in Irwindale, CA. The solar thermal installation will drive key industrial process heat applications at the facility to displace natural gas and electricity use. It is anticipated that the integrated solar thermal application(s) will be replicable in other plants and similar settings across California and elsewhere, improving energy efficiency, reducing greenhouse gas emissions, reducing reliance on fossil fuels, and benefiting California rate payers.

Research Justification and Goals

This project "[will develop, and help bring to market] increased energy efficiency in buildings, appliances, lighting, and other applications beyond applicable standards, and that benefit electric utility customers" (Public Resources Code 25620.1.(b)(2)), (Chapter 512, Statues of 2006)). It also supports California's goal to establish a program to encourage solar hot water heating to reduce the reliance on natural gas for water heating per the Energy Action Plan 2005 by demonstrating a medium temperature non-tracking solar collectors at the SAB Miller brewing facility in Irwindale, CA. The solar thermal installation will drive key industrial process heat applications at the facility - displacing natural gas and electricity use.

Background

The proposal was submitted through a competitive solicitation under the Emerging Technology Demonstrations Grants Program (ETDG) Opportunity Notice 08-006. This opportunity notice was structured to solicit proposals under four categories 1) Data Center, 2) Electricity Storage for Customer-side, 3) Industrial Energy Efficiency and 4) Water and Wastewater. This proposal was ranked number 2 out of 5 proposals received through the solicitation under the Industrial Energy Efficiency application category.

H2Go's solar thermal technology pairs an evacuated tube solar collector with an external non-imaging reflector in a non-tracking system. This combination enables External Compound Parabolic Concentrator to cost effectively achieve temperatures in excess of 392°F/200°C at 50% efficiency - which market incumbents cannot attain without tracking. The end result is a medium temperature non-tracking solar collector which can deliver at least 90% of peak heat through a 90 degree range of sky.

Based on strong proof-of-concept validation at UC Merced, SolFocus (a division of H2Go) built a fully instrumented 10 kW test bed at the NASA/Ames facility in Mountain View, California. The control loop includes a weather station and a telemetry system, allowing for remote adjustments and performance monitoring in a variety of climactic conditions. The NASA test project has been operating safely and continuously for more than six months. Data can be accessed under California Energy Commission sponsored project Agreement Number 500-05-021.

The project is specifically planned to bridge proven collector technology with appropriate industrial applications to replace fossil fuels with clean and cost-effective solar energy. The specific project objectives include:

- Prove the feasibility and safety of implementing medium temperature solar energy to meet a variety of industrial needs.
- Prove the possibility of installing a medium temperature solar thermal system at a cost less than $0.38/W to as low as $0.27/W.
- Prove that the XCPC technology can achieve the Levelized Cost of Energy (LCOE) at less than $0.032/kWh to as low as $0.021/kWh.

In addition to installing the collector system, the project will address issues of fuel switching, controls, application integration, carbon abatement, and economics. It is anticipated that there will be significant research produced in all of these areas. The high temperature heat 392°F/200°C from the collectors is planned to be used directly for industrial process heating or indirectly in combination with steam production for industrial processes. At least 5 million Btu heat input is considered to be used for the pilot solar thermal installation.

Although the technology has been proven to work effectively in the medium temperature range, the major barrier that hinders quick market awareness and adoption is lack of demonstration of industrial applications with evidence of proposed value. Therefore, this project represents an essential vehicle to link the applicant with industrial partners for proving the credibility of both the ability to commercialize the technology and to materialize the value that will benefit all parties including the state of California.

The project being proposed at SAB Miller will demonstrate the feasibility of the medium temperature solar thermal solution to drive industrial processes both in breweries and wider industrial settings. A successful pilot installation at a leading industrial company such as SAB Miller should have a strong impact on speeding market adoption of solar thermal technology. While photovoltaic solar technologies are readily understood by business, the benefits of solar thermal/heat driven technologies have historically been more difficult to convey. More high profile installations are needed to demonstrate feasibility, reliability, and economic viability in a real world setting. Overall risk through demonstration of technology in the target market is reduced and validation of performance by California utilities is crucial to achieve technology acceptance of potential end-users.

With approximately 50,000 industrial plants, California's industrial sector consumes almost 50 billion kilowatt hours of electricity and over 6 billion therms of natural gas each year. This energy represents 19% of the state's total end-use electricity and 47% of the state's end-use natural gas consumption. Over the past decades, such pressures as urbanization, regulations, higher costs for energy, water, and other resources, global competition, and limitations on effluents have motivated the industrial sector to search for ways to reduce energy and water use, while maintaining product quality and increasing productivity.

GTI, located in Des Plaines, Illinois, is the premiere Research and Development (R&D) organization for the natural gas industry, and also performs R&D in a wide variety of energy and environmental areas.

GTI typically operates by forming project teams with commercial partners to ensure that new technologies make successful transition to the marketplace. GTI will be the prime contractor and assume overall administrative responsibilities for the project, overseeing the activities of the subcontractors, and coordinating the management of project funds. GTI will also provide overall technical management and assume responsibility for the technical success of the project. This project will be managed under GTI's End Use Solution and Power Generation Group, which has been developing ultra-low-NOx combustion technologies for boilers, furnaces, and other industrial processes since the 1980's.

GTI currently manages approximately $50 million in government and industrial cost-type R&D contracts per year.